MECHANICS.

No. I.

SPHEROMETER.

The SILVER MEDAL *was presented to Mr. A. Ross, 33 Regent Street, for his Spherometer.*

SIR, 33 *Regent Street, Jan.* 27, 1841.

I WISH to submit to the Society an instrument for measuring spheres. I cannot spare it at present; but I shall be ready to produce it, with a drawing and description, whenever it is referred to a Committee.

I am, Sir, &c. &c.

W. A. GRAHAM, *Esq.* ANDREW ROSS.

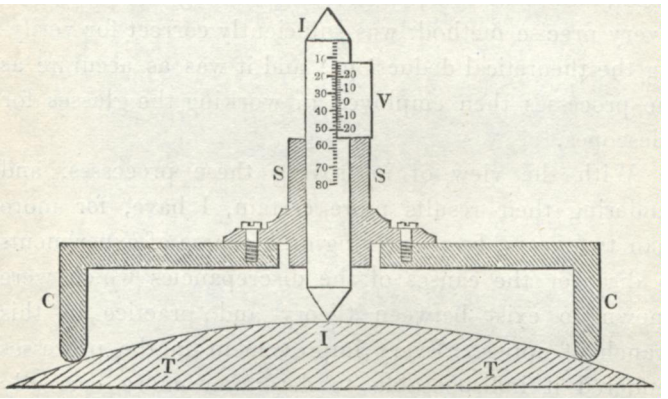
During a series of experiments, instituted many years since by Professor Barlow, for verifying his method of computing the curvatures of an achromatic object-glass, in which I was practically engaged, it became necessary to ascertain with considerable accuracy the radii of curvature of the tools on which the lenses were ground. The method then adopted was that of grinding in the

tool the edge of a plate of glass till the edge accurately fitted the tool, and formed what is called a template. This was laid upon a board in which two pins were inserted, and the template, guided by the pins, was made to describe an arc of great extent. The chord and versed sine of this large arc being carefully drawn and measured afforded data for calculating the radius by the well-known formula, $2\,R = \frac{\left(\frac{c}{2}\right)^2}{v} + v$, where R is the radius, c the chord, and v the versed sine. This, though obviously not a very precise method, was sufficiently correct for verifying the theoretical deductions; and it was as accurate as the processes then employed in working the glasses for telescopes.

With the view of improving these processes, and rendering their results more certain, I have, for more than two years, been carrying on a course of experiments to discover the causes of the discrepancies which were known to exist between theory and practice in this branch of optics. Every improvement in the processes rendered it indispensable to determine more correctly slight variations in the radii of curvature, to accomplish which I was led to invent the instrument which I now offer to the notice of the Society.

Its principle and general features are explained in the accompanying sketch, where T T represents a portion of the convex tool to be measured; and as tools are of necessity made in pairs we require to measure only one of each. A short cylinder C C, nearly closed at one end, has its edge very accurately turned and ground to a portion of a circle whose radius is known. In the cylinder is attached a carefully made square socket S S, in which

fits and moves the square index bar I I, the extremities of which are finished with hard steel cones. Upon these conical terminations as centres the circular edge of the cylinder C C is ultimately turned and ground, so that all errors of workmanship in fitting and fixing the socket to the cylinder are completely obviated. The index bar I I is divided on one face to $\frac{1}{50}$th of an inch, and a vernier V is secured to the socket by which it may be read to $\frac{1}{1000}$th of an inch, or, by estimation, to $\frac{1}{2000}$th.



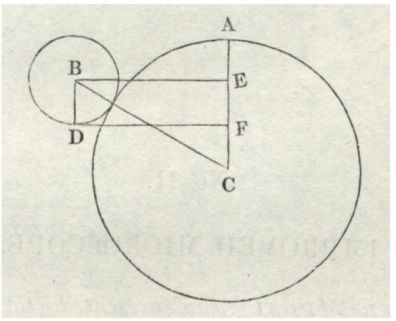
If the edge of the cylinder had been made square instead of circular, then the clear diameter of the cylinder would have been in all cases the value of the chord; but the difficulty of preserving a square angular edge perfectly true, and the different manner in which such a form would lie on spheres of small and large radii, induced me to adopt the circular edge, by which, of course, the value of the measured chord varies with every change of curvature in the tool. To obtain the value of the radius without determining the value of the varying chord I have devised the following formula:—

Let B E = F D, the known semi-diameter, or half the distance between the centres of the small circles, which form the edge (which is determined by gently rubbing the cylinder on a perfectly flat surface and measuring the diameter of the ring thus marked on the circular edge) ..... = a

A F the apparent versed sine as indicated by the vernier = v

E F = B D the known radius of the edge of the spherometer ..... = r

A C = the radius of the tool sought..... = R



Then A E = $v - r$

C E = R $-$ (v $-r$) = R $+ r - v$

C B^2 = C E^2 + B E^2

that is, $(R + r)^2 = (R + r - v)^2 + a^2$

$= (R + r)^2 - 2\,v\,(R + r) + v^2 + a^2$

$\therefore \quad 0 = v^2 + a^2 - 2\,v\,(R + r)$

and $2\,v\,(R + r) = v^2 + a^2$

or $\quad R = \frac{v^2 + a^2}{2\,v} - r.$

DEAR SIR, *Woolwich, Feb.* 24, 1841.

As you wished me to give my opinion of Mr. Ross's Spherometer, I beg to say, that in principle it is perfectly correct, and with the assistance of good workmanship,

such as Mr. Ross is capable of, I have no doubt it is also practically accurate. Mr. Ross is well able to judge of the delicacy of the measure requisite in carrying out theoretical investigations so as to render them of practical utility; and I have no doubt that in his hands such an instrument as his Spherometer would be of real practical utility.

I am, dear Sir, &c. &c.

W. A. Graham, Esq. Peter Barlow.

No. II.

IMPROVED MICROSCOPE.

The Silver Medal was presented to Mr. Hugh Powell, 24 Clarendon Street, Somers Town, for the following Communication on his Method of Mounting the Body of a Microscope.

24 *Clarendon Street, Somers Town,*

Sir, *April* 12, 1841.

I beg leave to submit to the consideration of the Society of Arts a new mode of mounting the body of a microscope, and shall have much pleasure in laying the same before the Committee.

I am, Sir, &c. &c.

W. A. Graham, Esq.
Secretary, &c. &c.

Hugh Powell.